

For the 320 stations in Group 5, whose total capital investment in HD equipment is \$6.9 million, the net incremental cost of the transition is found to be \$5.85 million. These projections are presented in Figure 10.

For all the 630 stations included in Groups 1-5, the average capital investment in HD equipment is 8.0 million per station, while the average total incremental cost over the assumed capital investment in maintaining and updating NTSC equipment is 5.8 million per station, to which must be added the remaining \$0.8 million cost of maintaining some NTSC equipment during the transition, for a total net incremental cost of \$6.6 million.

6.2. Capital Depreciation Charges

The impact of capital depreciation charges against revenues during the conversion period is significant. Assuming a 5-year straight line depreciation rate for HD equipment, the total depreciation charges for the 630 stations considered amount to \$2,680 million, or an average total depreciation charge of \$4.3 million per station. For tax purposes, this reduces the average total net cash flow for the acquisition of HD equipment to \$3.7 million per station, considering only the period of conversion. Additional depreciation charges will, of course, be taken in the five years following the last year of the conversion program.

INCREMENTAL CAPITAL COST OF HDTV EQUIPMENT PER STATION \$ MILLIONS*

STATION GROUP	NO. OF STATIONS	HD EQUIPMENT CAPITAL INVESTMENT	HISTORIC NTSC CAPITAL INVESTMENT DURING TRANSITION PERIOD	REMAINING NTSC INVESTMENT DURING TRANSITION	NET INCREMENTAL CAPITAL COST
1	30	11.6	5.0	2.3	8.9
2	40	10.4	3.0	1.2	8.6
3	80	9.3	2.8	0.9	7.4
4	160	8.1	2.1	0.75	6.75
5	320	6.9	1.6	0.55	5.85

* IN 1990 DOLLARS

FIGURE 10



7. TRANSITION SCHEDULES

Each station is expected to implement its transition to HDTV over a period of several years, thus spreading the capital investment required over a period of from five to nine years, depending upon marketplace and competitive considerations.

The first stations to introduce HDTV service will probably be large stations in the top television markets. These are likely to be followed by stations in progressively smaller markets.

For example, the transition schedule may follow the pattern shown in Figure 11. Starting in Year 1, with the first group of 30 stations to convert, all of which serve the top ten television markets, the number of television households served, and the percentage of all TV households (TVHH), are presented.

Assuming this scenario, each group of stations will take several years to implement full conversion, with the first group of 30 stations taking 5 years, and the last Group 6 of 640 stations, many of whom will be in smaller markets, completing the conversion in 9 years. In this scenario, the timing of conversion for each group is shown in Figure 12.

HDTV TRANSITION SCHEDULE

START YEAR	GROUP NO.	STATIONS EQUIPPED	MARKET RANKINGS SERVED	TV HOUSEHOLDS SERVED (MILLIONS)	PERCENT TVHH SERVED
1	1	30	1-10	28	31
2	2	+40=70	1-30	48	53
3	3	+80=150	1-100	76	83
4	4	+160=310	1-150	84	95
5	5	+320=630	ALL	88	98
6	6	+640=1270	ALL	90	100

FIGURE 11



HD CONVERSION SCHEDULE BY PHASES FOR EACH GROUP OF STATIONS

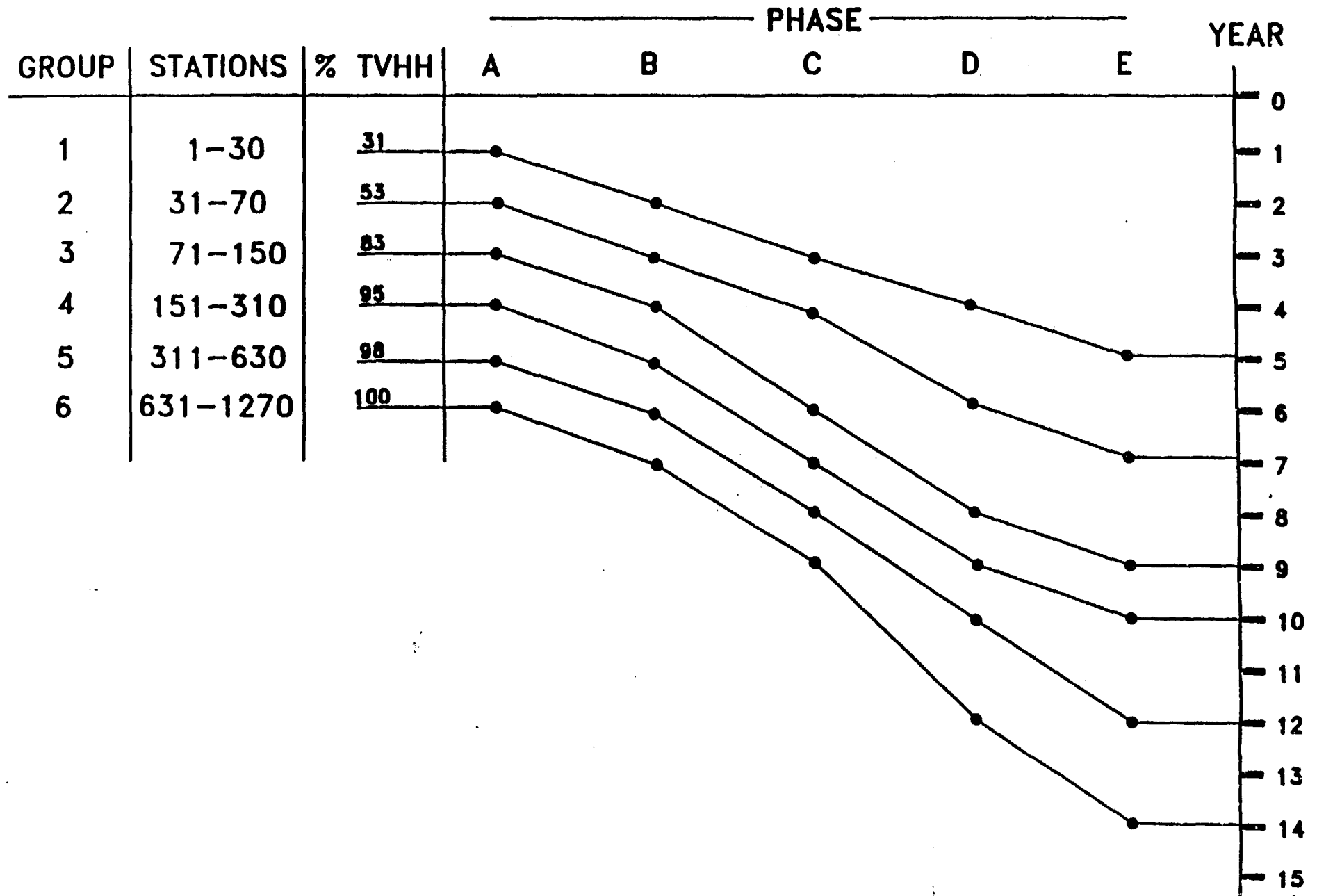


FIGURE 12

Figure 12 shows, for example, that when Group 2 has reached Phase D of the transition in the sixth year, 53% of television households will have HDTV service available, while in the eighth year, when the 160 stations in Group 3 have achieved Phase D, 83% or 76 million households will have HDTV service available.

The last Phase (F) of conversion to high definition electronic news gathering is not shown, because many stations may defer this phase for some years, as discussed previously.

8. CONCLUSIONS

At this point in the study, the following working premises are put forward for industry discussion.

- (i) Phasing the transition to simulcast HDTV over several years is essential so that stations can time and pace their transition program based on their financial capacity and marketplace considerations. Such a transition scenario appears feasible.
- (ii) The transmitter power for HDTV broadcast will be much less than for a NTSC transmitter, and the transmitting antenna will thus be smaller than its NTSC variant. New tower requirements for HDTV broadcast will therefore be minimal.
- (iii) Equipment costs will decline significantly over the period of industry conversion to HDTV broadcasting.
- (iv) The total capital investment required for transition to simulcast HDTV may range from \$11.6 million for major market stations converting early to \$6.9 million for small market converting later.
- (v) The incremental capital investment required for the transition to simulcast HDTV may range from \$9 million for major market stations to \$6 million for small market stations.

These projections of capital cost are presented in Figure 13.

SIMULCAST HIGH DEFINITION TERRESTRIAL BROADCAST CAPITAL INVESTMENT REQUIRED \$ MILLIONS

		GROUPS OF STATIONS ACQUIRING EQUIPMENT				
GROUP		1	2	3	4	5
NO. OF STATIONS		30	+40=70	+80=150	+160=310	+320=630
% TVHH SERVED		31	53	83	95	98
A -	TOTAL CAPITAL COST PER STATION	11.6	10.4	9.3	8.1	6.9
B -	TOTAL INCREMENTAL COST OVER HISTORIC NORMAL NTSC CAPITAL COST	8.9	8.6	7.4	6.8	5.9

* IN 1990 DOLLARS

FIGURE 13

APPENDIX A

Towers for Simulcast Advanced Television Systems

The following is a memorandum submitted by Jules Cohen and Associates, PC., to Specialist Group 10 of the Planning Subcommittee's Working Party 3, dated June 19, 1990.

"In estimates of the cost of initiating an Advanced Television System (ATV), a major item often included is a new tower. A survey of technical directors of television stations yielded the conclusion that, in the judgment of the technical directors, a substantial number of stations would require new towers to accommodate an additional antenna for ATV. For the reasons given below, new tower requirements are believed to have been exaggerated.

The ATV system adopted for terrestrial transmission will have to be of such nature that it can be located at 100 to 120 miles from a co-channel NTSC broadcast station without causing interference to reception of the NTSC station to a degree any greater than co-channel NTSC stations now cause to each other when spaced in the order of 180 miles. Inherent in that requirement is the need for the ATV station to provide satisfactory service to a substantial area while using less effective radiated power (ERP) than the equivalent NTSC station. Lower ERP can mean not only smaller transmitters, but also smaller antennas and smaller diameter coaxial cable than its NTSC counterpart.

Smaller antennas and cables reduce the weight required to be hung on a tower, but even more important, the smaller antennas and cables reduce the wind load. A tower not capable of carrying double its present load may very well be capable of accepting a lesser load without excessive derating.

Prior to adding anything other than a trivial load to a tower, a stress analysis is necessary. Such analyses are likely to cost in the range of six to fifteen thousand dollars. Upon completion of the stress analysis, the tower owner is advised of what members, if any, in the tower would be over stressed if the new load is added. Substantial overloading of a large number of members will mean that the tower must be replaced. However, experience with similar situations indicates that

the excessive stress is more often than not confined to a relatively small number of members.

In the instance where the number of tower members needing attention is not excessive, the members can be replaced or reinforced. Sometimes the requirement is as simple as adding a second steel angle back-to-back with the steel angle already in place. Sometimes one or more guy levels must be supplied with larger diameter guys, or an additional group of guys provided at a new level, perhaps with other guys being repositioned.

Strengthening an existing tower is much less costly than building a new tower. Even a fairly extensive amount of work can be accomplished within a one hundred thousand dollar budget. Furthermore, that work can usually be accomplished without disrupting the station operation.

Quite obviously, all existing towers cannot be subjected to a stress analysis at this time to arrive at a more realistic cost figure for the ATV conversion. However, experience dictates a conclusion that relatively few stations would have to resort to tower replacement as a condition for adding a simulcast ATV channel."

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Implementation Subcommittee
Third Interim Report
to the
FCC Advisory Committee on Advanced Television Service

James J. Tietjen
Chairman, Implementation Subcommittee

Charles L. Jackson
Chairman, IS/Working Party 1

J. Peter Bingham
Chairman, IS/Working Party 2

Implementation Subcommittee Status

The Implementation Subcommittee is comprised of two Working Parties which deal with issues related to policy and regulation and potential scenarios associated with making a transition from existing television service to an advanced television system (ATV). The objectives of Working Party 1 (Policy and Regulation) are to define and address the policies and regulations appropriate to guide the implementation process in order to recommend appropriate FCC actions in overseeing the implementation of an Advanced Television Service. The objectives of Working Party 2 (Transition Scenarios) are to critique the transition process for various generic system concepts in order to evaluate their implementation requirements and to develop an implementation plan for the selected system.

Working Party 1 (Policy and Regulation)

Working Party 1 has identified two areas where it could make significant contributions to the development of sound policies towards ATV. These areas are:

- (1) The FCC's role in setting broadcast transmission standards. In particular, does the FCC have the legal authority to choose a single standard, should it exercise that authority, or should it leave the development of standards to the marketplace?
- (2) The Ashbacker issue. Can the FCC set aside ATV spectrum for the use of existing broadcasters or divide limited spectrum among broadcasters (say three augmentation channels in a town with four TV stations) without a hearing or opportunity for competing applications?

Additionally, the Working Party, in response to a request from the FCC, has examined issues related to the problem of assigning individual ATV channels (augmentation or simulcast) to broadcast operators.

Developing a consensus on papers on the assignment issue and on the Ashbacker issue has been slow. These papers are still being perfected.

The standards issue has proved more tractable. The working party adopted two papers on the standards issue. (Copies of both of these papers are attached to this report.) One paper, titled **IS/WP1 Report on ATV Transmission Standards**, (IS/WP1-0020), discusses the legal authority and the policy basis for a single transmission standard. It concludes that the FCC has the authority to choose a single transmission standard, and that the FCC should announce its intention to so choose a single standard as soon as possible. The Working Party summarizes this conclusion with three specific statements:

- The Working Party has determined that the FCC has the legal authority to pick a single ATV standard for terrestrial broadcasting. It is virtually certain that the FCC's choice would be upheld on appeal, provided that the FCC had offered a reasonable basis for its choice and had observed the procedural requirements of the law.
- The Working Party believes that, given current knowledge, the choice by the FCC of a single terrestrial broadcasting ATV standard would strongly serve the public interest.
- The Working Party further concludes that, in order to promote cooperation among system developers and to facilitate the process of developing an industry-wide consensus, the FCC should, at the earliest possible time, announce its willingness to adopt, at the appropriate time, a single broadcast transmission standard.

The second standards paper, **Proprietary Standards in Advanced Television**, (IS/WP1-0025), as its name implies, discusses the policy issues associated with proprietary technology and intellectual property and the development of a federal standard for ATV.

During the next several months the Working Party intends to continue developing the papers on the Ashbacker issue and the assignment issue.

Working Party 2 (Transition Scenarios)

The dominant activity of Working Party 2 during the last 12 months was the refinement of the detailed PERT (program evaluation and review technique) charts and their integration into a single chart. Efforts continue to finalize the various industry PERT networks. Most individual industry networks have been completed with identification of dates and critical paths. Primary remaining efforts are in the area of broadcasting/transmitter facilities since these industries are most impacted by the specific ATV system proposal. Responses from a follow-up professional equipment manufacturer survey, currently in progress, are also needed in order to finalize the broadcast industry PERT network.

An overview transition scenario PERT network has been generated showing the various industry interdependencies. The final PERT network will be set up in a hierarchical fashion so that additional levels of detail can be evaluated. The finalized PERT chart(s) will be circulated amongst the ATV system proponents for review and feedback.

The final output from Working Party 2 will be a group of timelines for the different transition scenario categories that identify the transition time to an Advanced Television Service in the United States. Target for completion of a final report is the third quarter 1990.

Timeline and PERT-Chart Activity

Information obtained so far by the Working Party indicates the following:

- Development for consumer products can start 3...5 months after results of ATTC (Advanced Television Test Center, Inc.) testing are available. The type of system will influence the overall development time: augmentation and/or simulcast systems will require more lengthy product development due to more critical RF issues and additional receiver complexity. Displays will not be in the critical path. Products are expected to be available 18...24 months after FCC decision.
- The cable industry is expected to require 6 months in case of a simulcast or 6 MHz solution without scrambling. In case of scrambling and/or augmentation, a switchover time of up to 30 months seems to be more likely.
- The time to upgrade the satellite link to ATV is system dependent as well. Under the assumption that existing satellites can be utilized, immediate transmission is possible if there is no change in modulation and transmission parameters. Should the system call for a redesign or new development of exciters and receivers, a range of 18...24 months would have to be planned for. The transcoder between terrestrial and satellite format forms a potential bottleneck: the estimated design time of 18...24 months (exclusive of laboratory and field tests) necessitates a design start prior to FCC system approval to avoid the satellite path becoming the critical one.
- For common carrier, immediate service is possible in some cases while others may require equipment modification or replacement. In any case, ATV transport by common carrier is expected to be accomplished within 6 months of an ATV system decision.

- The terrestrial transmission upgrade is believed to form the critical path. A well planned and exercised upgrade of the transmission equipment should be completed within 18 to 24 months as long as no legal action is required to settle zoning problems and/or citizens complaints against the new structure (expected to happen in approximately 10% of all cases). Stations in densely populated areas are most prone to face these types of problems which will not only delay the process by up to several years but increase cost as well, in some cases by several million dollars.

In the northern part of the country, weather-related delays have to be taken into account as well.

- For the production area it was found that film production will not be in the critical path, whereas electronic production may be sensitive to the system selection. For the latter issue, a much stronger involvement of equipment suppliers is necessary for clarification; the response rate to the Working Party survey to date is only poor and efforts are under way to change this. A final time estimate cannot be given yet. Cost estimates for ATV production equipment are under development at SS/WP3 on economic assessment.

The indication that the transmitter facility is likely to be a critical factor in an overall transition scenario prompted the establishment of the following transition scenario categories for the purpose of generating PERT networks:

1. Existing transmitter facility can be used, no major modification required.
2. Additional transmitter/antenna facility required
 - a) existing tower acceptable
 - b) new tower required.

An initial PERT network for category 1, using proponent system ACTV-I as example, is in the process of being developed.

Additional Activity (IS/WP2)

In addition to these planned activities, two additional topics had to be dealt with and were completed. During early 1989 several issues were brought before the Implementation Subcommittee by Lex Felker [then Chief, FCC Mass Media Bureau; presently Technology/Engineering Consultant with Wiley, Rein & Fielding]. Two of these issues fell under the responsibility of Working Party 2 and are stated as follows:

- (1) If different systems appear to be preferable for cable, broadcast, satellite, and/or VCR, would fostering convergence be beneficial? How could this be accomplished? What statutes or regulations could be used, or would have to be amended? Same questions, if different ATV systems prove to have different strengths and weaknesses; would convergence to obtain the best of the different systems be beneficial, and if so, how can the result be pursued?
- (2) Some broadcasters have complained that any ATV system which will require a new antenna site will be impractical. How pervasive is this problem? What is the magnitude of the problem in dollars; number of stations potentially affected? Is this problem so severe as to rule out anything other than a six megahertz, compatible system?

In the case of Item (1), it was decided to support Working Party 1 with a technical statement concerning ATV system convergence issues. A subgroup was established and a report was submitted to WP1.

The report outlined, that even if one basic ATV system is embraced by all media, technical reasons require varying detailed implementation for the different media. Such a 'family' exists presently for NTSC and is characterized by the possibility of simple translation from one media to the other.

The report concluded that -- if different [ATV-]systems appear to be preferable for cable, broadcast, satellite and/or VCR -- fostering convergence

- a) would be beneficial from a technical/economical perspective to the extent of assuring interoperability of the receiver/display with different media in an uncomplicated manner and without unnecessary cost. This means that interfaces should be defined which allow different media to utilize the maximum functionality of the receiver/display (convergence at the consumer hardware).
- b) is an obvious demand of the marketplace: cable will have to distribute broadcast signals to consumers, consumer VCR's will have to record and play back ATV signals received from (at least) broadcast, cable media, and satellites (convergence intermedia--i.e. the ability of various media to handle signals originated by other).

Definition of a terrestrial standard and appropriate display interfaces should bring sufficient commonality between media. It is too early to establish standards for alternate media delivery to consumers which does not involve broadcast. Even if regulation of these heretofore unregulated media is contemplated, a set of competing proposals specifically tailored to these media must exist before a standard definition is potentially needed.

The necessary activities to encourage and technically define this convergence are in place with the FCC-ACATS and in the industry in the form of the EIA (Electronic Industries Association) standard setting activity for interface and ATSC (Advanced Television Systems Committee) consideration of these same issues.

To resolve Item (2), a two-part study was carried out to determine in detail the situation of the US television stations in the matter of a potential upgrade of a two-channel ATV system. The study focused on transmission equipment (transmitter, antenna, and tower) only. The first part consisted of a round of interviews with approximately 350 Chief Engineers, Technical Directors, or Station Managers. The goal was to determine statistically significant information on the availability of antenna space on the existing towers and the possibility to erect additional towers if needed. In the second part, time estimates for this upgrade were developed to be used as input to the PERT charts.

The survey indicates that there exist some major markets which are likely to experience severe technical and political difficulties when trying to obtain additional tower space. The majority of TV stations in these markets share one or two (community-) towers in the midst of a heavily populated area. Expansion possibilities are limited and plans for new towers are often opposed by the local population and/or government. Examples for these markets are: New York (World Trade Center and Empire State building), Chicago (Sears tower and Hancock building), San Francisco (Mount Sutro) and Minneapolis-St. Paul (three-tower cluster for all stations). Boston, MA, should be mentioned as well because of its strict radiation limits.

As for overall results, in case a full-power 2-channel ATV system would be selected, approximately **28%** of all surveyed stations would be able to accommodate the second antenna on their existing tower with no or only minor modifications. Seven per cent (**7%**) could upgrade their existing structure. The remaining 65% could either erect an additional tower at the existing site (**30%**) or would have to develop a new tower site (**35%**).

The percentages for an upgrade to a low-power ATV system are 50%, 5%, 19% and 26% respectively.

There is no statistically significant correlation between ADI (area of dominant influence) rank and fraction of positive responses for both cases.

The 1989 NAB (National Association of Broadcasters) survey contained three questions formulated by IS/WP2 dealing with the same issue. Draft results just became available and their consistency with the outcome of the Working Party survey has still to be verified.

As for dollar figures, SS/WP3 on economic assessment is in the process of refining their data on upgrade cost. A consolidation with the WP2 survey results has not been performed yet.

Future Activities (IS/WP2)

Near-term tasks awaiting completion are:

1. Compilation of information from professional equipment manufacturer survey;
2. Identification of broadcast/transmitter facility PERT chart dates for the two categories of systems; and
3. Establishment of software links between the overview transition scenario and the detailed industry charts.

This work will be completed by midyear 1990.

The final output from Working Party 2 will be a group of timelines for the different transition scenario categories that identify the transition time to an Advanced Television Service in the United States. Target for completion of a final report is the third quarter 1990.

Supporting Information

The detailed information supporting this status summary is included as an Appendix.

List of appendices:

Appendix A: Summary PERT chart

Appendix B: Timeline summary

Appendix C: 'Lex Felker Issues'

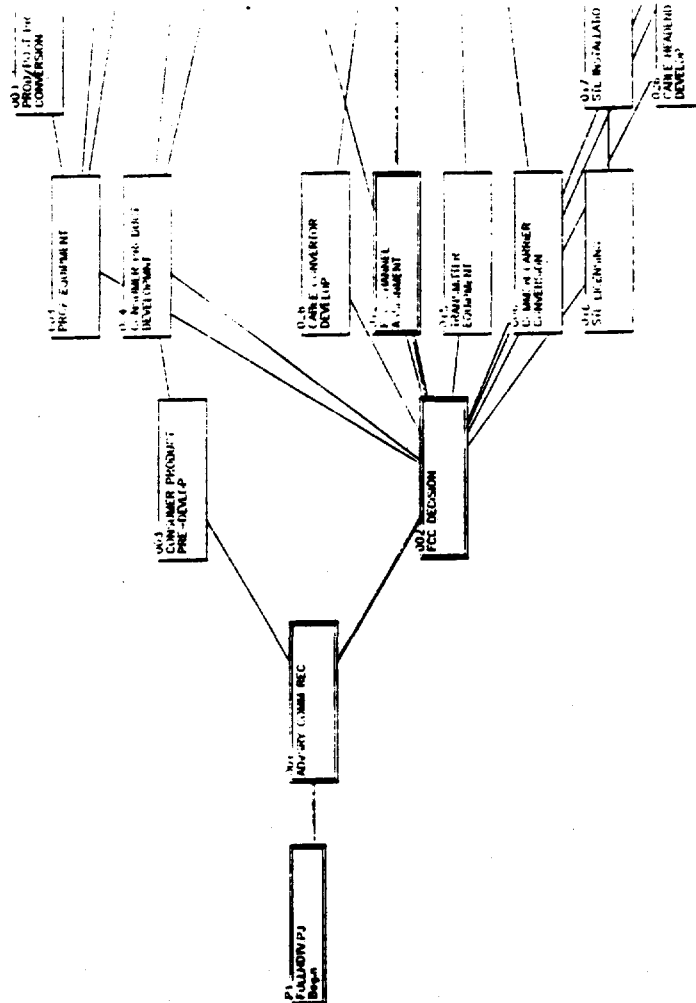
Appendix D: TV-Station Survey - Table of Results

Attachment 1: Specialist Group Report on ATV System
Convergence

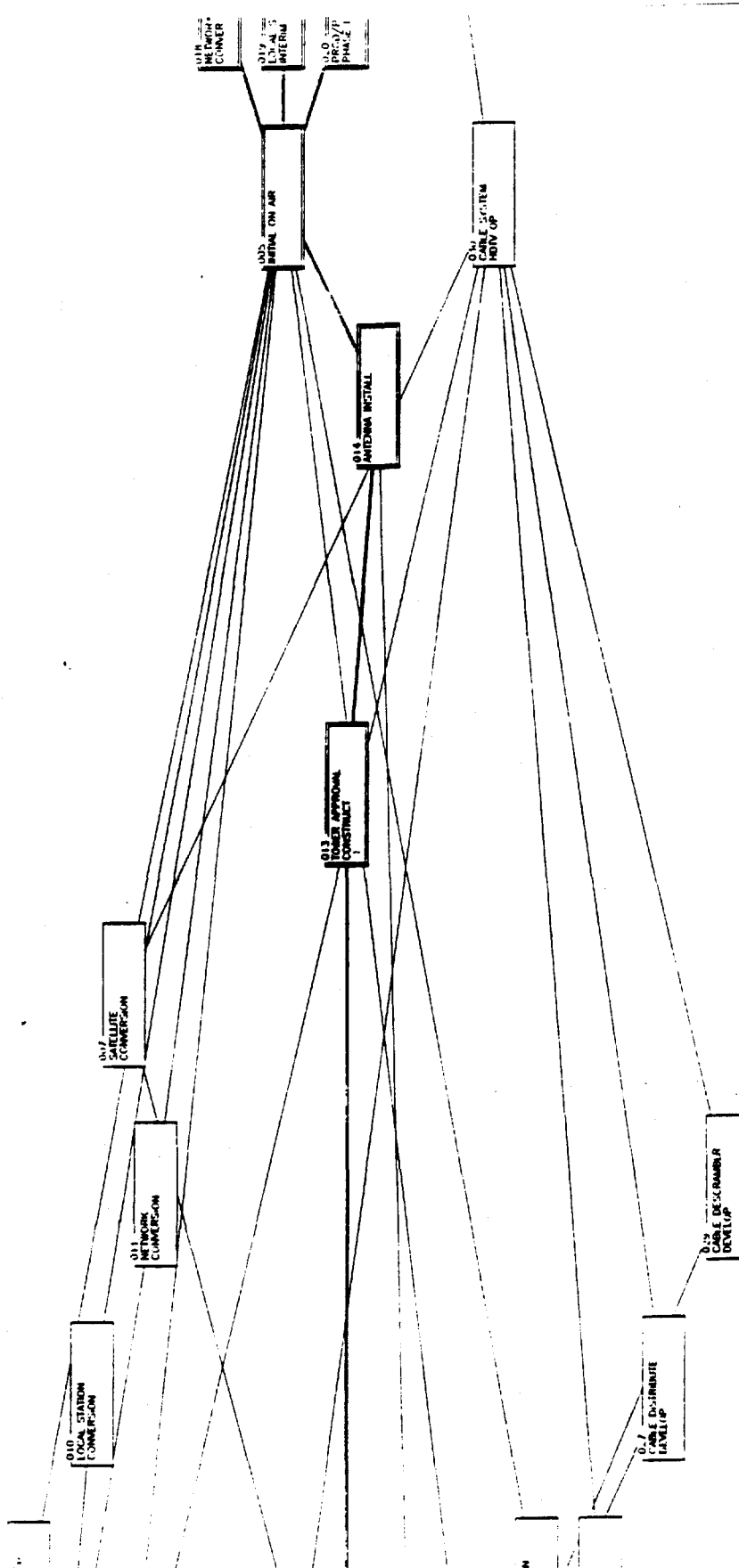
Attachment 2: TV-Station Survey - Final Report

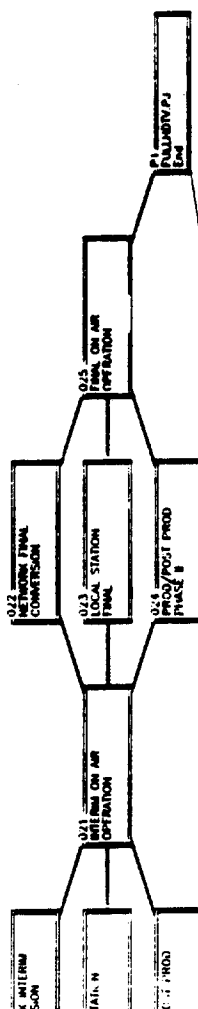
Attachment 3: IS/WP1 Report on ATV Transmission Standards
(IS/WP1-0020, 7 Nov 89)

Attachment 4: Proprietary Standards in Advanced Television
(IS/WP1-0025, 12 Dec 89)



Appendix A: Summary PERT chart





INDUSTRY TIMELINES

- CONSUMER PRODUCTS 18 - 24 MONTHS
- CABLE 6 - 30 MONTHS
- SATELLITE 0 - 32 MONTHS
- COMMON CARRIER 0 - 6 MONTHS
- TERRESTRIAL 18 - 24 MONTHS
(IF NO COMPLICATIONS)
- PRODUCTION ?

ZERO DATE - FCC APPROVAL